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HARVARD UNIVERSITY



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Museum of
Comparative Zoology

ANNUAL REPORT
OF
THE DIRECTOR
OF THE
MUSEUM OF COMPARATIVE ZOÖLOGY
AT HARVARD COLLEGE
TO THE
PRESIDENT AND FELLOWS OF HARVARD COLLEGE
FOR
1914-1915.

CAMBRIDGE, U. S. A.:
PRINTED FOR THE MUSEUM.

1915.

REPORTS ON THE SCIENTIFIC RESULTS OF THE EXPEDITION TO THE EASTERN TROPICAL PACIFIC, IN CHARGE OF ALEXANDER AGASSIZ, BY THE U. S. FISH COMMISSION STEAMER "ALBATROSS," FROM OCTOBER, 1904, TO MARCH, 1905, LIEUTENANT COMMANDER L. M. GARRETT, U. S. N., COMMANDING, PUBLISHED OR IN PREPARATION:—

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| <p>A. AGASSIZ. V.⁵ General Report on the Expedition.</p> <p>A. AGASSIZ. I.¹ Three Letters to Geo. M. Bowers, U. S. Fish Com.</p> <p>A. AGASSIZ and H. L. CLARK. The Echini.</p> <p>H. B. BIGELOW. XVI.¹⁶ The Medusae.</p> <p>H. B. BIGELOW. XXIII.²³ The Siphonophores.</p> <p>H. B. BIGELOW. XXVI.²⁶ The Ctenophores.</p> <p>R. P. BIGELOW. The Stomatopods.</p> <p>O. CARLGREN. The Actinaria.</p> <p>R. V. CHAMBERLIN. The Annelids.</p> <p>H. L. CLARK. The Holothurians.</p> <p>H. L. CLARK. The Starfishes.</p> <p>H. L. CLARK. The Ophiurans.</p> <p>S. F. CLARKE. VIII.⁸ The Hydroids.</p> <p>W. R. COE. The Nemerteans.</p> <p>L. J. COLE. XIX.¹⁹ The Pycnogonida.</p> <p>W. H. DALL. XIV.¹⁴ The Mollusks.</p> <p>C. R. EASTMAN. VII.⁷ The Sharks' Teeth.</p> <p>S. GARMAN. XII.¹² The Reptiles.</p> <p>H. J. HANSEN. The Cirripeds.</p> <p>H. J. HANSEN. XXVII.²⁷ The Schizopods.</p> <p>S. HENSHAW. The Insects.</p> <p>W. E. HOYLE. The Cephalopods.</p> <p>W. C. KENDALL and L. RADCLIFFE. XXV.²⁵ The Fishes.</p> <p>C. A. KOFOID. III.³ IX.⁹ XX.²⁰ The Protozoa.</p> | <p>C. A. KOFOID and J. R. MICHENER. XXII.²² The Protozoa.</p> <p>C. A. KOFOID and E. J. RIGDEN. XXIV.²⁴ The Protozoa.</p> <p>P. KRUMBACH. The Sagittae.</p> <p>R. VON LENDENFELD. XXI.²¹ The Siliceous Sponges.</p> <p>R. VON LENDENFELD. XXIX.²⁹ Hexactinellida.</p> <p>G. W. MÜLLER. The Ostracods.</p> <p>JOHN MURRAY and G. V. LEE. XVII.¹⁷ The Bottom Specimens.</p> <p>MARY J. RATHBUN. X.¹⁰ The Crustacea Decapoda.</p> <p>HARRIET RICHARDSON. II.² The Isopods.</p> <p>W. E. RITTER. IV.⁴ The Tunicates.</p> <p>B. L. ROBINSON. The Plants.</p> <p>G. O. SARS. The Copepods.</p> <p>F. E. SCHULZE. XI.¹¹ The Xenophyphoras.</p> <p>HARRIET R. SEARLE. XXVIII.²⁸ Isopods.</p> <p>H. R. SIMROTH. Pteropods, Heteropods.</p> <p>E. C. STARKS. XIII.¹³ Atelaxia.</p> <p>TH. STUDER. The Alcyonaria.</p> <p>JH. THIELE. XV.¹⁵ Bathysciadium.</p> <p>T. W. VAUGHAN. VI.⁶ The Corals.</p> <p>R. WOLTERECK. XVIII.¹⁸ The Amphipods.</p> |
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¹ Bull. M. C. Z., Vol. XLVI., No. 4, April, 1905, 22 pp.

² Bull. M. C. Z., Vol. XLVI., No. 6, July, 1905, 4 pp., 1 pl.

³ Bull. M. C. Z., Vol. XLVI., No. 9, September, 1905, 5 pp., 1 pl.

⁴ Bull. M. C. Z., Vol. XLVI., No. 13, January, 1906, 22 pp., 3 pls.

⁵ Mem. M. C. Z., Vol. XXXIII., January, 1906, 90 pp., 96 pls.

⁶ Bull. M. C. Z., Vol. L., No. 3, August, 1906, 14 pp., 10 pls.

⁷ Bull. M. C. Z., Vol. L., No. 4, November, 1906, 26 pp., 4 pls.

⁸ Mem. M. C. Z., Vol. XXXV., No. 1, February, 1907, 20 pp., 15 pls.

⁹ Bull. M. C. Z., Vol. L., No. 6, February, 1907, 48 pp., 18 pls.

¹⁰ Mem. M. C. Z., Vol. XXXV., No. 2, August, 1907, 56 pp., 9 pls.

¹¹ Bull. M. C. Z., Vol. LI., No. 6, November, 1907, 22 pp., 1 pl.

¹² Bull. M. C. Z., Vol. LII., No. 1, June, 1908, 14 pp., 1 pl.

¹³ Bull. M. C. Z., Vol. LII., No. 2, July, 1908, 8 pp., 5 pls.

¹⁴ Bull. M. C. Z., Vol. XLIII., No. 6, October, 1908, 285 pp., 22 pls.

¹⁵ Bull. M. C. Z., Vol. LII., No. 5, October, 1908, 11 pp., 2 pls.

¹⁶ Mem. M. C. Z., Vol. XXXVII., February, 1909, 243 pp., 48 pls.

¹⁷ Mem. M. C. Z., Vol. XXXVIII., No. 1, June, 1909, 172 pp., 5 pls., 3 maps.

¹⁸ Bull. M. C. Z., Vol. LII., No. 9, June, 1909, 26 pp., 8 pls.

¹⁹ Bull. M. C. Z., Vol. LII., No. 11, August, 1909, 10 pp., 3 pls.

²⁰ Bull. M. C. Z., Vol. LII., No. 13, September, 1909, 48 pp., 4 pls.

²¹ Mem. M. C. Z., Vol. XLI., August, September, 1910, 323 pp., 56 pls.

²² Bull. M. C. Z., Vol. LIV., No. 7, August, 1911, 38 pp.

²³ Mem. M. C. Z., Vol. XXXVIII., No. 2, December, 1911, 232 pp., 32 pls.

²⁴ Bull. M. C. Z., Vol. LIV., No. 10, February, 1912, 16 pp., 2 pls.

²⁵ Mem. M. C. Z., Vol. XXXV., No. 3, April, 1912, 98 pp., 8 pls.

²⁶ Bull. M. C. Z., Vol. LIV., No. 12, April, 1912, 38 pp., 2 pls.

²⁷ Mem. M. C. Z., Vol. XXXV., No. 4, July, 1912, 124 pp., 12 pls.

²⁸ Bull. M. C. Z., Vol. LVIII., No. 8, August, 1914, 14 pp.

²⁹ Mem. M. C. Z., Vol. XLII., June, 1915, 397 pp., 109 pls.

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REPORT.

TO THE PRESIDENT AND FELLOWS OF HARVARD COLLEGE:—

MOST of the courses of instruction in Zoölogy, Geology, and Geography offered in Harvard University and in Radcliffe College during the Academic year 1914–1915 were given, as in past years, in the Laboratories and Lecture Rooms of the Museum.

The seven courses and thirteen half courses in Zoölogy in Harvard University were taken by 472 students, and the four courses and six half courses in Radcliffe College were taken by 164 students.

In 1913–1914 these courses and students were:—

Harvard:— 20 courses, 453 students.

Radcliffe:— 9 courses, 68 students.

In Geology and Geography eleven courses and fifteen half courses were taken by 461 students in Harvard University and two courses and six half courses were taken by 78 students in Radcliffe College.

In 1913–1914 these courses and students were:—

Harvard:— 18 courses, 367 students.

Radcliffe:— 6 courses, 48 students.

During the month of July the Museum placed its large Lecture Room at the disposal of the School Committee of the City of Cambridge to aid them in their effort to foster an interest in natural history among school children.

Mr. George R. Agassiz has most generously added twenty-five thousand dollars (\$25,000.00) to the permanent funds of the Museum, the income to be used for the general purposes of the Museum.

Early in the year 1913 Mr. Samuel Mixter of Boston suggested that the Museum coöperate with him in a proposed expedition to the Kamtchatkan Peninsula by sending a competent collector to secure a series of birds and mammals. This the Museum was enabled to do through the unsolicited generosity of Prof.

Theodore Lyman, a generosity effectively increased by Col. John E. Thayer who added an experienced field naturalist to the personnel of the party. Fortunate in having the generous interest of Colonel Thayer and Professor Lyman, the Museum was equally fortunate in the men, Messrs. Joseph Dixon and W. Sprague Brooks, selected for the zoölogical work. In addition to Messrs. Mixter, Brooks, and Dixon, Messrs. E. S. Draper, John Heard, Jr., Dunbar Lockwood, and G. S. Silsbee, all recent students in Harvard University, accompanied the expedition. Originally planned for six months' work, chiefly on the Kamtchatkan Peninsula and along its coast, conditions proving unfavorable, most of the collecting was done along the coasts of Siberia and Alaska, and the time extended from the proposed six months to sixteen included an Arctic winter when both material and opportunities for zoölogical work are limited. Notwithstanding the many untoward circumstances, Messrs. Dixon and Brooks by their skill, industry, and perseverance, gathered a representative series of mammals and birds together with a smaller collection of insects and shells. After his return, Mr. Brooks studied the series of birds and has prepared a report on the 160 species contained in the collection.

Through Dr. Thomas Barbour's interest in the West Indian fauna, very many of the departmental collections have been substantially increased. In addition to material presented by local naturalists, notably Dr. C. de la Torre, Sr. V. J. Rodriguey, Sr. Francisco Morales, and Mr. C. T. Ramsden, Dr. Barbour aided in securing the collections made by Mr. J. L. Peters in Cuba and by Mr. G. K. Noble in Guadeloupe. Mr. Noble's collection of birds includes not only all the species known from Guadeloupe and adjacent islands, but also series sufficient in many cases for the characterization of insular variation. He also collected a large number of reptiles in excellent preservation with accurate data. During March and April, 1915, Dr. Barbour, assisted by Mr. W. S. Brooks, made large collections in Cuba and the Isle of Pines. Directing their attention principally to the species of birds and reptiles not represented in the collections of the Museum, they were so fortunate as to secure many of the rarest and most desirable Cuban species. Though at times, owing to severe physical disability, Mr. Brooks was better fitted for the hospital than the field, he gave Dr. Barbour invaluable aid throughout the trip.

Dr. H. B. Bigelow has continued in charge of the scientific work carried on by the U. S. F. S. GRAMPUS in the North Atlantic.

Though with distinct economic bearing, the work of the GRAMPUS, is placed upon a reliable scientific basis, through the establishment of oceanographic and plankton stations, and by the accumulation of data dealing with temperature, salinity, the abundance and distribution of food-materials, etc.

Dr. G. M. Allen, at the invitation of and accompanied by Prof. Theodore Lyman, spent four weeks collecting in the southern Sierra Nevada, Cal. The collection made at the edge of the desert and at 11,000 feet on Mt. Whitney consists of insects, reptiles, and mammals; of the last about seventy specimens were secured, including several species new to the Museum collection. Dr. Allen, collecting at Tupper Lake, N. Y., at the invitation of Dr. Barbour, secured a series of several eastern mammals some of which show "a differentiation from their coastal representatives."

Mr. W. F. Clapp's field work included collecting in Lake Champlain in the vicinity of Chimney Point, Vt. With the aid of the Rev. R. K. Smith, very large series of nearly all the species of mollusks reported from the region were obtained.

Dr. P. E. Raymond, during two brief trips to the Mohawk Valley, N. Y., and one trip to Pennsylvania occupying two weeks, collected a large number of interesting fossils.

Dr. G. M. Allen has continued his services for three days each week; with the exception of a few unprepared skins of large species, the entire series of skins of recent mammals is catalogued and arranged in scientific sequence. Dr. Allen also reports considerable progress in the rearrangement and the incorporation into one series of the osteological and fossil collections of mammals.

A large amount of routine work upon the collection of birds has been accomplished by the Associate Curators, Mr. Outram Bangs and Dr. J. C. Phillips. This work consists not only of the identification, cataloguing, and arrangement of current accessions, but a review, in connection with the Lafresnaye and other collections of birds received from the Boston Society of Natural History, of the entire series, both exhibition and research, of the Museum collections; though time consuming, this work improves both series and emphasizes the deficiencies in each. Another time consuming but unavoidable labor is the response to calls for the loan of material for scientific study. These calls, also frequently made for mammals, have increased noticeably during recent years, an increase due to the growth and recognized importance of the Museum collections.

Among the lower vertebrates, Dr. Thomas Barbour has kept the identification and cataloguing of the Reptilia and Amphibia up to date and has made considerable progress in working over portions of the collection not recently studied.

Mr. Samuel Garman notes improvement in the collection of fishes and progress in the identification, labeling, and cataloguing of the same.

Mr. J. D. Sornborger has worked throughout the year in the preparation of osteological specimens of mammals and birds.

As Museum Preparator, Mr. George Nelson's work is in evidence in every exhibition room and in most of the research collections; his photographic skill is of frequent service for the illustration of the publications of the Museum and for those of specialists connected with other museums.

Dr. R. V. Chamberlin's time has been given over chiefly to two pieces of arachnid research and to the incidental Museum work connected with the same; the first, a review of the collection of Aviculariidae, (trap-door spiders), and the second, a report on the collection of Arachnida made by the Yale Peruvian Expedition in 1911. This valuable collection, presented to the Museum by Prof. H. W. Foote, contains more than eighty new species.

Mr. W. F. Clapp was engaged during the year with a revisional rearrangement of several families of univalve mollusks and with a similar treatment of the species of *Achatinella*, *Partula*, *Physa*, *Lymnaea*, and *Succinea*. A part of this material has been catalogued, also the accessions for the year.

Dr. H. L. Clark's principal work consisted of a complete review of the collection of recent ophiurans (brittle-stars), a review undertaken in connection with the preparation of an illustrated catalogue of the ophiurans of the World. The Museum collection contains more than 21,000 specimens, representing more than half the known species. Another research, a report on a portion of the ENDEAVOUR echinoderms and undertaken at the request of the Australian Museum, has been completed by Dr. Clark.

Dr. H. B. Bigelow has completed the catalogue of pelagic Coelenterata of which the collection contains over 300 species and about 10,000 specimens. He has also made some progress in cataloguing the hydroids and stony corals.

The services of Prof. L. E. Griffin were secured for two weeks, during which he identified and labeled the greater portion of the Barrier Reef corals.

Prof. P. E. Raymond's Museum work included a study of the

fossils collected during the trip to the Baltic provinces in 1914 and the preparation of a report on the same. Owing to the European war, a considerable part of the collection made in 1914 has not been received.

Owing to ill health, Miss Elvira Wood's work was limited to the assortment of a considerable series of fossils received from the Boston Society of Natural History.

Mr. R. W. Sayles has improved and increased the geological collections on exhibition and has been most successful in advancing the educational value of the same. He notes with great satisfaction that this section of the Museum is open to the public for a part of each day throughout the year and his report of more than 40,000 visitors during the five months, March to July, 1915, fully justifies the generosity of the Committee on Geology, Mineralogy, and Petrography in providing for the services of a watchman.

The Museum is indebted to Miss E. B. Bryant for many additions to the series of North American spiders; these additions are the result of her own efforts and of those she has interested in the collection of the Museum. Miss Bryant has also spent considerable time in keeping this collection in good order.

The rearrangement of the Geometridae continues under the supervision of Mr. L. W. Swett, and the Museum is under obligations to him for this service as well as for the addition of many desirable specimens.

The bequest of the late W. McM. Woodworth became available during the year. This bequest includes specimens, apparatus, books, pamphlets, photographs, and pictures. The ethnographic specimens, relating chiefly to the South Sea Islands, have been deposited in the Peabody Museum; the accessions to the Library so far as entered, number over 800 titles.

The collections of mammals and birds have been increased through the interest and generosity of Col. J. E. Thayer and Dr. J. C. Phillips.

The Hon. W. Cameron Forbes has presented a very desirable series of birds collected during his recent trip to South America.

Prof. H. W. Smith during his visit to Sarawak obtained a large amount of interesting material including an exceptionally valuable series of birds and reptiles.

For some years, Mr. C. T. Ramsden has contributed Cuban vertebrates and invertebrates of value; among those received this year, especial mention should be made of a skin of the ex-

tremely rare Cuban Ivory-billed Woodpecker, *Campephilus bairdii* Cassin.

During recent years, Prof. C. H. Eigemann has been interested in the study of South American fresh-water fishes, and by his own efforts and those of his assistants and students, he has amassed an enormous collection. For a fine series representing many species of these fishes, the Museum is indebted to the kindness of Mr. H. McK. Landon.

Other accessions for which separate mention should be made are:—

From the U. S. Bureau of Fisheries and the U. S. Coast Survey, Coelenterates collected during cruises of the GRAMPUS and the BACHE.

From the U. S. National Museum, a series of Panamic starfishes, including cotypes of species described by Ludwig.

From Mr. J. H. Emerton, North American spiders, including types of his recently described species.

From Prof. J. W. Folsom, types of several new species of Collembola.

From Mr. E. D. Harris, a large series of Cicindelidae, including many species new to the collection of the Museum.

From Dr. C. A. Thomas, a Moose in excellent pelage with fine antlers, obtained by Dr. Thomas in New Brunswick for the North American exhibition collection.

The Museum is also indebted to Prof. W. M. Wheeler for very many invertebrates from Australia and New Zealand; to Prof. G. H. Parker for some Alaskan invertebrates; to Mr. J. J. Rorer for a small collection of bats; to Dr. A. E. Hodson for specimens of *Epicrates* and *Capromys* from Cuba; to Mr. W. B. Cabot for several Caribou antlers from Labrador and to Prof. J. M. Clarke for some exhibition specimens of *Hydnoceras*.

The Library consist of 52,634 volumes, and 49,306 pamphlets; 1,135 volumes and 1,590 pamphlets have been added during the year.

The publications of the year include one volume and one number of the *Memoirs*, nine numbers of the *Bulletin*, and the *Annual Report*, a total of 772 (403 quarto, 369 octavo) pages, and 148 (120 quarto, and 28 octavo) plates.

The volume of *Memoirs* and one number of the *Bulletin* were published under the provisions of Mr. Agassiz's Expedition Fund; one number of the *Bulletin* was issued as a Contribution from the Zoölogical Laboratory, and one number was issued in the Geo-

logical series; six numbers of the Bulletin contain reports on the Museum collections or the result of field work of the Museum staff. The final Contribution from the Newport Laboratory (Memoirs, vol. 40, no. 9) contains the unfinished work of Mr. Agassiz and Dr. Whitman on the development of osseous fishes.

The Corporation granted \$300.00 to aid in the publication of Contributions from the laboratories of zoölogy and geology.

By the death of Miss Frances M. Slack on 24 February, 1915, the Museum lost its oldest officer. Miss Slack was first employed in the Library in November, 1870, and though incapacitated during recent years, it was her privilege to serve the Museum for forty years, giving for this long period a willing service which is remembered with gratitude.

SAMUEL HENSHAW,
Director.

REPORT ON THE ZOÖLOGICAL LABORATORY.

BY E. L. MARK.

There were no material changes in the courses of instruction in Zoölogy given during the academic year 1914-1915 by the regular staff of teachers, as compared with those given in the preceding year. As usual, the numbers of persons in each of the various college classes and groups of students who elected the several courses offered, are given in tabular form for both Harvard University (Table I) and Radcliffe College (Table II).

TABLE I.

Courses for 1914-15	Graduates		Sen.	Jun.	Soph.	Fresh.	Uncl.	ocC.	Sp.	Med.	Total
	A. & S.	Ap. S.									
Zoölogy 1	1		19	35	56	53	9	1	2	2	178
" 2	4		21	36	24	13	9		2		109
" 3	3+5		4	9	10	5					31+5
" 4	5+1		4	7	4		1		1		22+1
" 5a	6+3		4	5+1	1						16+4
" 7a	7	2	1		2						12
" 7b	6	2	1		2						11
" 7c		3	3								6
" 11	8+3	2	2	5	2		1				20+3
" 12	6		1								7
" 14b	12+4	2	2	3	1						20+4
" 17	6+1	+1	1	1+1							8+3
" 20a	3										3
" 20b	1										1
" 20c	8										8
" 20d	2										2
" 20e	1			1							2
" 20f		9	1								10
" 20g	2										2
" 20h		2			1						3
" Special					1						1
Sums	81+17	22+1	64	102+2	104	71	20	1	5	2	472+20

NOTE: Numbers in italics indicate students who attended the lectures, but were not enrolled in the course. To make numbers directly comparable with those of previous years, these are not incorporated with the enrolled students.

TABLE II.

Courses 1914-1915	Gr.	Sen.	Jun.	Soph.	Fresh.	Uncl.	Sp.	Total
Zoölogy 1		2	5	15	32	3	6	63
" 2		11	19	16	22	6	7	81
" 3	1			1	1			3
" 5a		1	1					2
" 7a	1	1		1			1	4
" 14b	2	4						6
" 17		1						1
" 20c	1						1	2
" 20e			1					1
" 20g		1						1
Sums	5	21	26	33	55	9	15	164

The laboratory accommodations for Zoölogy 1, given by Professor Parker, continue to be barely adequate for the number of students applying for this course. Any further increase in numbers will result in turning away applicants unless a larger laboratory can be secured. The chief assistants in the Harvard course were Messrs. L. B. Arey and H. G. Coar, the sub-assistants Messrs. J. P. Baumberger, H. E. Hamlin, H. R. Hunt, H. Jordan, and D. E. Minnich. In Radcliffe the chief assistant was Mr. H. D. Fish and the sub-assistants were Messrs. J. P. Baumberger and A. C. Redfield.

Professor Castle had as his assistant in Zoölogy 2, Mr. H. D. Fish. The lectures were attended by a number of advanced students not specializing in Zoölogy and not enrolled. On authority of the Committee on instruction in Harvard, Zoölogy 2 was given in Radcliffe by Dr. C. C. Little and Mr. H. D. Fish jointly.

This is the third year since the experiment was undertaken of reducing the work on the Comparative anatomy of vertebrates (Zoölogy 3) from a full course to a half course. Professor Rand is of the opinion, strengthened by each year's experience, that "the time is too short for a really adequate treatment of the subject," and in this opinion I concur. The chief assistant in this course was Mr. A. C. Redfield, the sub-assistant Mr. H. R. Hunt. In the Radcliffe course Mr. D. E. Minnich was the assistant.

Zoölogy 4 under Assistant Professor Rand is consciously being slowly changed in the direction of comparative histology, it being the instructor's belief that such a course is needed by prospective medical students as well as by students of Zoölogy. The assistant in the course was Mr. A. C. Redfield.

The lectures in Zoölogy 5a covered only the early stages in the embryology of vertebrates. Mr. D. H. Wenrich was the assistant in charge of the laboratory work in both Harvard and Radcliffe.

The lectures of the courses in Entomology — Zoölogy 7a, 7b and 7c — were given partly in Cambridge and partly in connection with the laboratory work, which was carried on at the Bussey Institution. Courses 7a and 7b were given by Professor Wheeler and Assistant Professor Brues. Course 7a in Radcliffe and course 7c were given by Assistant Professor Brues.

The course in variation, heredity, and breeding (Zoölogy and Botany 11) was given by Professors Castle and East.

The assistant in Zoölogy 12 was Mr. D. H. Wenrich. The course was given by Professor Mark.

Zoölogy 14b, given by Professor Parker, was taken as either a thesis course or a laboratory course. Each of those who elected the laboratory work was assigned a special topic — eight in Harvard, and one in Radcliffe. Of the former, four reached results thought to be worthy of publication.

Of the eight Harvard students taking Zoölogy 17 under Assistant Professor Rand, five took the course with laboratory work, and the Radcliffe student also elected laboratory work. The others wrote theses on assigned topics.

Professor Parker gave a course of lectures on Zoölogy, with laboratory work, to twenty-three teachers in the Teachers' School of Science. The exercises occupied two hours every Saturday afternoon during the first half year. The assistant was Mr. W. J. Crozier.

In research there were thirty-one enrolments in Harvard, four in Radcliffe. The work done was, for office purposes, regarded as the equivalent of courses as follows: in Harvard, Zoölogy 20a and 20b, under Professor Mark, six courses, Zoölogy 20c, under Professor Parker, eleven and a half courses, Zoölogy 20d, under Professor Castle, six courses, Zoölogy 20e and 20g, under Assistant Professor Rand, three and a half courses, Zoölogy 20f and 20h, under Professor Wheeler, seventeen courses; in Radcliffe, Zoölogy 20c (Professor Parker) two courses, Zoölogy 20e and 20g (Assistant Professor Rand) one and a half courses. Research courses 20d, 20f, and 20h were carried on at the Bussey Institution.

The degree of Ph.D. was conferred on William John Crozier in February, 1915. His thesis, Studies on sensory stimulation, embraced four investigations entitled respectively:— 1. The sensory reactions of *Holothuria surinamensis* Ludwig; 2. The orien-

tation of a holothurian by light; 3. A note on the physiology of the Cuvierian organs of *Holothuria captiva* Ludwig; 4. The rhythmic pulsation of the cloaca of holothurians. The same degree was conferred in June, 1915, on Leslie Brainerd Arey, whose thesis was on The movements in the visual cells and retinal pigment of the lower vertebrates, and on David Henry Wenrich, whose thesis was on The spermatogenesis of *Phrynotettix magnus*, with special reference to synapsis and the individuality of the chromosomes.

There were twelve persons, including the Director, in attendance at the Bermuda Biological Station for Research this summer. The Station was opened June 18, and most of those enrolled left on August 3. Through the generous assistance of persons interested in Harvard University and Radcliffe College, the Station has been put on a more desirable footing. Hitherto it has been open during only a few weeks each summer. By the appointment of Dr. William J. Crozier as Resident Naturalist, and Mrs. Crozier as Librarian and Recorder, for a period of three years, and by a renewal for the same period of the privileges granted by the Bermuda Natural History Society in support of the undertaking, the Station is assured a more productive future. Hereafter it will be possible for investigators of either plant or animal life, and those interested in oceanographic problems to carry on their work at the Station at any season of the year. Five of the students from Harvard received aid from the Humboldt Fund aggregating \$278.86, and one other received from a private source \$50.

The Harvard Table at the Marine Biological Laboratory, Woods Hole, was occupied from June 30 to August 10 by two graduate students, one pursuing the course in physiology, the other the course in embryology.

The Radcliffe Table was shared by a zoölogical student of the class of 1915, taking the course in embryology, and a botanical student.

A Harvard graduate student and a special student of Radcliffe carried on work at the laboratory of the United States Bureau of Fisheries at Woods Hole.

The Zoölogical Club held twenty-six meetings, at which there were presented twenty-eight original papers and numerous abstracts and reviews. The average attendance was over nineteen.

A list of the Contributions from the Zoölogical Laboratory and Contributions from the Bermuda Biological Station is given on p. 41-42; other papers by members of the department are indicated under their names.

REPORT OF THE STURGIS HOOPER PROFESSOR OF GEOLOGY.

BY REGINALD A. DALY.

In addition to his duties as a Museum officer, the writer has continued to act as chairman of the Department of Geology and Geography, and to give instruction. During the year he conducted the following courses:— Geology 4, Geology 9, and Geology 20c. Three students enrolled in Course 20c completed theses for the doctor's degree. Their titles are:— The Acadian Triassic by Sidney Powers; The Glamorgan Gabbro body and its associated rocks [Ontario] by Wilbur G. Foye; and The geology of the Walker Mountain overthrust block in Southwestern Virginia by Ellis W. Shuler. Mr. Shuler's work was supervised more especially by Professors Woodworth and Raymond.

In the autumn the proof-reading of a volume on the geology along the Canadian Pacific Railway between Golden and Kamloops (a distance of 200 miles) was completed; the book has since been issued as a memoir of the Geological Survey of Canada. Manuscripts describing the results of three new researches were prepared for publication. One of these relates to the origin of the iron ore at Kiruna, Sweden, where the required field work was done in 1914. A rather full statement of The glacial-control theory of coral reefs was written. Much of the year was spent on a compilation of existing geographical and geological data on the Pacific islands. Special care was taken to secure all available information as to the islands showing "continental" rock types, and as to the detailed petrography of the volcanic islands. The results, prepared in tabular form, are completed. Some of the material collected was used in writing an address given on August 3rd at a general meeting of the American Association for the Advancement of Science at San Francisco, the subject being Problems of the Pacific Islands. The paper, part or all of which will be published, presents a plan for the systematic exploration of all the oceanic islands of the Pacific.

The field work of the year consisted of: a study of the geological conditions faced by the engineers engaged in cutting the five-mile tunnel on the Canadian Pacific Railway at Rogers Pass in the Selkirk Mountains; work on the geology about Butte and Helena, Montana; and briefer studies in the Crater Lake National Park, in the Yosemite Valley, and elsewhere in the Cordillera.

REPORT OF THE DEPARTMENT OF GEOLOGY AND GEOGRAPHY.

BY REGINALD A. DALY.

This year the permanent staff of the Department remained the same as in 1913-1914. The assistants appointed for the year were: Dr. W. P. Haynes and Messrs. Francis Chamberlain, F. L. Cole, Sidney Powers, H. M. Sampson, E. W. Shuler, Edward Wigglesworth, and H. N. Witt. The Department was fortunate enough to secure the services of Dr. Ralph Arnold, who in April gave a course of ten lectures on the Geology of petroleum. He came at the joint invitation of this Department and the Department of Geology at the Massachusetts Institute of Technology, half of the course being given at each institution. The lectures were most stimulating and the geologists of Boston owe much to Dr. Arnold for his generosity in interrupting his busy professional life to give his masterly summary of a subject so important in economics and technology. The success of this informal course illustrates the need of a permanent professorship in the geology of the non-metals.

The number of students reached by the Department shows another gratifying increase. A comparative table gives its amount; it refers, however, only to courses taken during the winter sessions.

		1912-13	1913-14	1914-15
Harvard.	No. of courses and half courses given	15	18	23
	No. of students completing courses	232	367	440
Radcliffe.	No. of courses and half courses given	3	6	8
	No. of students completing courses	24	48	78

For the past year the numbers of students completing courses are shown in the following table:

	Harvard	Radcliffe		Harvard
Geology 1 (hf)	93	12	Geology 2 (hf)	11
" 4 (hf)	143	31	" 9 (hf)	5
" 5 (hf)	39	9	" 10	10
" 6 (hf)	28	9	" 12	4
" 8 (hf)	5	3	" 15 (hf)	12
" 20a	—	1	" 16 (hf)	5
" 20c	4	2	" 18	3
Meteorology 1 (hf)	53	11	" 20b	6
" 2 (hf)	2		Palaeontology 1 (hf)	4
" 3 (hf)	2		" 2 (hf)	4
" 5 (hf)	4		" 20	1
" 20	1		Geology S5	7
" 20a	1		Geology S6	14

Total, Harvard 461. Total, Radcliffe 78.

Within the year four men received the degree of Doctor of Philosophy in the field of Geology. This is the largest number securing the degree as administered by the Division of Geology, in any one year.

Immediately after graduating as Doctors of Philosophy, Messrs. W. G. Foye and Sidney Powers were given grants from the Sheldon Fund to enlarge their experience abroad. Dr. Powers was away from Cambridge about eight months, during which time he made extensive researches among the volcanoes of Hawaii, Japan, and the Philippines. Dr. Foye is in Fiji, investigating particularly the field facts bearing on the origin of coral reefs. Each worker has already secured much new material worthy of publication.

As last year, profitable coöperation in the training of graduate students has been carried on with the Geological Department of the Massachusetts Institute of Technology.

The members of the Visiting Committee, through the energetic chairman, Mr. George B. Leighton, have again given welcome and important aid to the Department. They have appreciated and encouraged the work by personal visits and by generous subscriptions of money where specially needed. One subscription, supplemented by a grant from the Corporation, has paid for the services of a watchman in the Geological and Mineralogical Museums, so that these rooms have been kept open to the public several extra days in the week; thus, by a comparatively small payment, a large amount of University capital has been kept more continuously at the work it was designed to do.

The Visiting Committee also subscribed the sum of \$700 to pay the expenses of the new summer field course in Colorado under

Professor Atwood. Like the long-established course in Montana, under Professor Woodworth, this was very successful. In all, twenty-one men completed the summer courses, which now may count for the higher degrees and afford the best kind and quantity of training in field methods. The large demand for these technical summer courses last summer illustrates the desirability of an endowment of the summer courses beyond that of the invaluable Sayles Fund.

Messrs. Robert W. Sayles and Edward Wigglesworth continued their voluntary and highly appreciated work as the respective curators of the Exhibition Collections and Gardner Collection of Photographs. Mr. Wigglesworth generously acted as assistant in Geology 8, without salary. In June he began an investigation of Martha's Vineyard under the general direction of Professor Woodworth. The summer's work suggests some new correlations of the formations in that island with those of Long Island and indicates the necessity of revising former ideas as to the nature and magnitude of the Glacial moraine in Martha's Vineyard.

This year the Josiah Dwight Whitney scholarship was divided between Messrs. J. L. Ferguson, H. V. Smith and H. N. Witt, all studying field geology in the western Cordillera. From an unexpended balance of the Sayles Summer School Fund, financial aid was also supplied to Mr. T. H. Clark, a student working in the Montana field course.

The report of Mr. Sayles will be found on another page. It is eloquent of his activity and of the truly remarkable figures showing by actual count the great number of visitors to the Geological Museum. Mr. Sayles also mentions the high efficiency of our preparator and custodian, Mr. G. M. Flint, an opinion shared by all members of the Department.

Mr. Edward Wigglesworth has summarized the condition of the Gardner Collection of Photographs in the following table:

	Photos	Slides	Negatives
Accessions since last report	90	903	35
Unidentified views	150	0	155
Duplicates	116	0	0
Broken	0	0	0
Last accession number	7,505	8,326	0
Number now in collection	7,394	8,326	1,119
Card catalogued	0	8,326	0

The more important additions to the collection are: (1) Professor Davis's negatives taken during his Shaler Memorial Expedition to the southern Pacific. Both prints and lantern slides have been made from these. (2) A large number of slides and photographs obtained for Professor Atwood, many of which are from his own negatives. These are to be used in the courses on physiography. (3) A set of 156 lantern slides purchased from Dr. Ralph Arnold illustrating the geology of petroleum. This lot is not included in the foregoing table, since they have not as yet been completely catalogued. For the same reason, 181 slides and 109 photographs of Scottish subjects, referred to in last year's report of the Sturgis Hooper Professor, have not been entered in the table.

The collection now contains an abundant supply of material for use in all the courses except those on economic geology. With the coöperation of Professor Graton it is hoped to supply this deficiency in the near future; the policy now being to improve the quality, rather than to increase the size, of the collection.

During the year Professor Woodworth gave Courses 5, 8, 12 and 20c at Harvard and Courses 4, 5, 8 and 20c at Radcliffe. His 20c course at Harvard was taken by two students, one a candidate for the doctorate, the other, a senior, whose work counted as a whole course in the second half year. The Rocky Mountain Summer Course in Geology (S5) was given by him between July 3rd and August 6th in the region between Bozeman and Virginia City, Montana. This course was taken in 1915 by seven men, two from Yale University, one from the Institute of Technology but now in this University, and four from Harvard.

The work of the Seismographic Station was maintained throughout the year. Monthly mimeographed bulletins of earthquakes were issued to stations offering exchange of data, and a revision and summary of these records prepared for the sixth annual report of the Station. Considerable time was spent in tabulating the hours at which earthquakes occur in relation to the question of the hour of maximum frequency and the rôle played by barometric changes. A paper dealing with the preliminary results of this investigation has been nearly completed.

As a result of his work upon the Walker Mountain fault block in Virginia, Mr. Ellis W. Shuler received the degree of Ph.D. at Commencement. His thesis deals with the structure of the fault block and with the stratigraphy of a much debated geological section. In the summer of 1915, Mr. Ralph P. Wentworth, a

student in Geology S20c, spent ten weeks tracing out the upper marine limit of the so-called Champlain sea from Cape Ann along the coast of New Hampshire and Maine to and beyond Portland, with the result that the extent of the submergence appears now to be satisfactorily determined.

Professor Raymond gave Palaeontology 1, 2, and 20. Three papers were published by students as a result of work done in Palaeontology 20:—by R. M. Field. 1. The use of the Roentgen ray in palaeontology. *Amer. journ. sci.*, May, 1915, ser. 4, **39**, p. 543–550, pl. 8. 2. On the validity of the genus *Plethopeltis*. *Ottawa naturalist*, July, 1915, **29**, p. 37–43; by E. W. Shuler. 3. A new Ordovician eurypterid. *Amer. journ. sci.*, May, 1915, ser. 4, **39**, p. 551–554, f. 1–6. Mr. Shuler devoted the greater part of his time in Palaeontology 20 to his thesis *The geology of the Walker Mountain overthrust block*.

An unexpended balance of the grant from the Shaler Memorial Fund allotted in the previous year enabled Professor Raymond to spend two weeks in Pennsylvania in the study of certain sections whose interpretation had a direct bearing upon the problems of the correlation of the eastern American with the northern European Ordovicians. During this trip he was accompanied by Mr. R. M. Field, and for a part of the time, by Mr. E. W. Shuler. In May, Professor Raymond, accompanied by the same graduate students, spent a week in studying certain problems in the stratigraphy of the Ordovician of the Mohawk Valley of New York.

The student collection has received during the year, by donation: Cambrian and Tertiary fossils from Mr. W. G. Foye; by purchase: about fifty specimens of Upper Cambrian fossils from Minnesota and Wisconsin, about 500 specimens of rocks and fossils from southwestern Virginia, and five plaster models of fossils.

In Economic Geology, Professor Graton gave the following courses: Geology 10, Geology 18 in part, and Geology 20b. Two changes from previous years may be noted in connection with these courses: (a) In Geology 10, laboratory work was offered for the first time and was pursued by about half the class. The experiment proved so satisfactory that laboratory work is now required. (b) As a part of Geology 18, non-metalliferous economic geology, Dr. Ralph Arnold gave the series of ten lectures on the Geology of petroleum, already noted. The attendance at these lectures, ranging from 38 to 65, about half of them Harvard men, contrasted strongly with the small number of students registering each year in the regular work of Geology 18, and indicates how

desirable it is to secure a number of such experts each year to handle the specialized and exceedingly diverse branches of this important course.

During the year, the expenditures of the Secondary Enrichment Investigation amounted to about \$16,000. The field work originally contemplated was practically completed and the laboratory studies, both in the Department laboratories in Cambridge and at the Geophysical Laboratory of the Carnegie Institution in Washington, were well advanced. One particular subject of research carried on by the Investigation, viz., Microscopic determination of the opaque minerals, was completed after four years of study by Mr. J. Murdoch, one of the graduate students of the Department, and the results, accepted as a Doctor's thesis, are now being published as a text-book. With support afforded by the Shaler Memorial Fund, the investigation was able to study the bearing of physiography on ore alteration through the work of Professor Atwood and a graduate student of the Department at mining camps in Montana and Utah in the summer of 1914.

During the summer of 1915, Professor Graton studied the ore deposits in four mining regions of Alaska and in three districts in California; while in the laboratory, the academic year was devoted to continuation of researches on American copper deposits and on the microscopic character of sulphide ores.

In addition to his courses on elementary physiography and the physiography of the United States (Geology 1 and Geology 6, both repeated in Radcliffe College), Professor Atwood took charge of Geology 16 (Glacial geology) and gave two new half courses, entitled Local field work in physiography (Geology 2) and Natural resources and their conservation (Geology 15).

Professor Atwood's new summer course in the San Juan Mountains of Colorado was highly successful. The opportunities for gaining correct and large ideas are abundant in that field. Four of the class were from other institutions. One of these has come to Harvard as a graduate student in the Department, two others have indicated that they hope to come here for their advanced work, and each of the Harvard men who took the summer school work will continue with additional courses in this Department during the present year. Some provision for the continuation of such work each summer, and the lengthening of the course from five to eight weeks should be made, so that, as in the engineering camp, a student may at very little additional expense complete the college requirements for one full course of instruction by re-

maining three weeks longer in the field. Having gained some skill in field methods, the student remaining the three additional weeks under instruction would profit perhaps more than by the first five weeks in the field.

Under the auspices of the U. S. Geological Survey, Professor Atwood has continued his studies of the physiography of the San Juan region. In association with students he has taken up the systematic study of the glacial deposits in and around Boston. During this work one of the students has discovered in Boston a pre-Wisconsin drift sheet.

Before the close of the year, Professor Atwood's Shaler Memorial study of the physiography of certain mining regions in relation to the secondary enrichment of ores was prepared for publication. An account of Eocene glacial deposits in southwestern Colorado was published by the U. S. Geological Survey as Professional Paper 95-B.

Mr. Clifford Swan of the class of 1908 presented a number of government reports for use in the geographical laboratory.

Professor Ward reports an increase in the number of students in the elementary course, Meteorology I, from 18 to 54. A new half course on the Climatology of the Eastern Hemisphere (Meteorology 5) was given for the first time. The establishment of this course satisfactorily rounds out the instruction which the Department is able to offer in Meteorology and Climatology. The climatological courses now cover all parts of the world. An ideal which has been before the Department for a quarter of a century has therefore been attained. The laboratory equipment has been increased by the purchase of the Oxford wall maps not previously in the collection, and of photographic enlargements of a considerable number of generalized type weather maps of the United States, selected and prepared by Professor Ward. Most of the bound volumes of meteorological journals which have for some years been deposited in the Climatological Laboratory, were transferred to the Harvard University Library, where they are more easily accessible to a larger number of persons. The laboratory work in elementary Meteorology would be greatly improved and stimulated if the ordinary instruments (thermometers, rain-gauge, etc.) could be exposed outdoors, under standard conditions, in some convenient location on the grounds close to the Geological Museum.

During the winter Professor Ward gave two public lectures on the Weather factor in the great war; one in the series on the

Geography of the war area, given in the Geological Museum, and the other at the joint meeting of the American Geographical Society and the Association of American Geographers in New York, April 9, 1915. He also gave two lectures on the geography of South America in History 57.

In the winter, Professor Ward completed a chapter on Meteorological Observations for the forthcoming Handbook of the Harvard Travellers Club, and a paper on the climatic subdivisions of the United States. He devoted his summer to work on the climatology of the United States, in connection with a book which he is preparing on this subject.

Professor McAdie reports that the expense of maintaining the Blue Hill Observatory has been met by the income from the endowment fund provided by the Founder and former Director, the late Professor Abbott Lawrence Rotch, supplemented by generous aid from Mrs. Rotch (a gift of \$1800) and Mr. George Wigglesworth (a gift of \$500). Special fire-proof cases for the records were provided by Mr. I. Tucker Burr. For the coming year some additional provision should be made to enable the Observatory to carry out certain experimental work in both the lower and higher strata of the air.

There have been no changes in its staff or general policy and the past year was one of quiet, cumulative effort along existing lines of work. The European war has disarranged all International coöperation; complete restoration of the good feeling and comity which previously existed among meteorologists is problematic, as two different schedules have been announced by Russia and Germany.

The buildings and general equipment are in good condition. Much needed improvements in connection with the water supply and plumbing have been made. The building is now lighted by electricity.

Instruction has been given to three graduate students, two of whom came from the Massachusetts Institute of Technology. Two courses were given: Meteorology 20a for graduate students; and Meteorology 6 for undergraduates who have taken certain other courses.

Aerological observations were continued as in previous years. The regular observational work has been continued and a series now covering a period of thirty years is complete. The observation of pressure, temperature, humidity, precipitation, sunshine, day and night cloudiness, and other meteorological phenomena

have been published in the Annals of Harvard College Observatory, vol. 73, part 2.

The Observatory has played a leading part in the propaganda for the adoption of scientific and rational units in meteorology. It offers an excellent opportunity for research work by the holder of a fellowship in the University.

REPORT OF THE MAMMALS.

BY OUTRAM BANGS.

The larger collections received during the year include:— 167 specimens from Alaska and eastern Siberia, the gift of Col. J. E. Thayer and Prof. Theodore Lyman, collected by Messrs. Joseph Dixon and W. S. Brooks; 130 specimens from Guadeloupe, collected by Mr. G. K. Noble, the gift of several friends of the Museum, and some desirable specimens from Texas and Trinidad, gifts of Col. J. E. Thayer and Mr. J. B. Rorer. The mammals collected during Dr. J. C. Phillips's Palestine expedition (22 March–12 May, 1914), the gift of Dr. Phillips, acknowledged in the Report M. C. Z. for 1913–1914, p. 4–5, number 144 specimens.

Single specimens or small series of specimens have been received from Mrs. F. A. Pierce, Messrs. G. M. Allen, H. R. Amory, Outram Bangs, Thomas Barbour, J. H. Blake, William Brewster, W. B. Cabot, W. E. Castle, M. L. Church, Joseph Flaherty, R. T. Jackson, A. V. Kidder, G. L. Kirk, J. D. MacF. MacDougall, T. K. Morton, G. H. Parker, J. L. Peters, J. F. Porter, C. T. Ramsden, Harold St. John, and J. D. Sornborger, the city of Boston (Department of Parks) the Boston Society of Natural History, Musée l'Herminier, Guadeloupe, W. I., and the Peabody Museum of American Archaeology and Ethnology.

Exchanges have been made with the Naturhistorisches Museum, Basel; American Museum of Natural History, New York; and the University of Michigan Museum, Ann Arbor.

REPORT ON THE BIRDS.

BY WILLIAM BREWSTER.

Upwards of 2300 bird skins, representing more than fifty species new to the Museum, have been added to its collection within the year. Very many of these have been contributed by generous and long-devoted friends. Col. J. E. Thayer and Prof. Theodore Lyman have given 750, of which 532 were collected by Messrs. W. S. Brooks and Joseph Dixon in Alaska between April, 1913 and September, 1914; 130 at Sachalin Island, in the summer of 1914; forty in northeastern Siberia. To Dr. Thomas Barbour we are indebted for 384 especially desirable birds, many of which were obtained by him personally in Cuba, with the assistance of Mr. W. S. Brooks, during the spring of the present year. Another collection (see Report M. C. Z., 1913-1914, p. 4-5) of exceptional interest, aggregating 460 skins, was made for the Museum by Dr. J. C. Phillips, assisted by Mr. W. M. Mann, in Syria, Arabia, Sinai, Palestine, and Suez, in the spring of 1914. During the summer of 1914 Mr. G. K. Noble, collecting in the Lesser Antilles, through the assistance of several friends of the Museum, obtained 367 birds, and Mr. J. L. Peters, stationed at Nipe Bay, Cuba, secured 209 specimens, which he has generously given to the Museum.

Acknowledgement should also be made in this connection for acceptable gifts of specimens received from Messrs. Outram Bangs, W. F. Clapp, G. W. Field, W. Cameron Forbes, S. J. Mixter, George Nelson, G. K. Noble, A. C. Redfield, G. C. Shattuck, W. M. Tyler, and W. E. Wall.

From the exchange with Clark University (Report M. C. Z., 1913-1914, p. 4), the Museum received the George Baur collection of Galapagos birds. This series numbers 117 specimens, representing fifty-four species, eleven of which were not before possessed by the Museum. A few birds have also been obtained by exchange with the British Museum.

Ninety-one skins of North American birds have been sent to Mrs. Mabel Osgood Wright to be used by her for Audubon

Society purposes and nineteen specimens have been given to Col. J. E. Thayer.

For purposes of scientific study or comparison, 849 bird skins have been loaned to Mr. Robert Ridgway, eleven to the U. S. National Museum, seventy-six to Mr. W. E. Clyde Todd at the Carnegie Museum, twenty-nine to Mr. F. M. Chapman, and one to Dr. E. A. Mearns.

REPORT ON THE REPTILES AND AMPHIBIANS.

BY THOMAS BARBOUR.

During the year all the time available for routine work has been consumed in identifying the new material received and entering it in the register and card catalogue. This work has been kept almost up to date.

Mention should be made of Mr. G. K. Noble's excellent West Indian collection, especially from Guadeloupe, which arrived just too late for inclusion in last year's report. Last March I left with Mr. W. S. Brooks for Cuba and the Island of Pines returning in May. Thanks to our many kind friends there, especially Dr. C. de la Torre, Sr. V. J. Rodriguez, and Sr. Francisco Morales, our journey was more successful than we had hoped. Special mention should also be made of the splendidly preserved and extensive collections obtained by Prof. Harrison W. Smith and his Dyak assistants during Professor Smith's explorations of the Limbang and Madalam Rivers in Upper Sarawak, Borneo. Mr. C. T. Ramsden of San Carlos, Guantanamo, Cuba, has continued to make frequent contributions of rare Cuban species.

Other gifts have been received from Profs. R. T. Fisher, W. M. Wheeler and from Messrs. G. W. Stevens, J. B. Rorer, C. A. Clark, and A. G. Ruthven. The Museum also profited by a visit of Dr. Stejneger who aided in determining and sorting out the types and figured specimens of North American chelonians used by Prof. Louis Agassiz in preparing his classic monograph.

Exchanges have been completed with the Queensland Museum, the Australian Museum, the British Museum, the U. S. National Museum, the Academy of Natural Sciences of Philadelphia, the California Academy of Sciences, the Museum of the University of Michigan.

Desirable material has also been purchased from several sources — particularly important being the specimens of *Cricosaura typica* secured by Mr. O. Torlin, at Belig, Cuba.

REPORT ON THE FISHES.

BY SAMUEL GARMAN.

In this department the work has been devoted to research with preparations for future publication and to improvements of the material; also the identification, labeling, and cataloguing of the specimens. Losses from corrosion, leakage, breakage, and evaporation have been less than in previous years.

Additions to the collections have been received from Messrs. Thomas Barbour, W. B. Cabot, W. F. Clapp, J. Dawson, C. L. Hay, W. M. Mann, R. E. Merwin, and from the Boston Society of Natural History; the last including important specimens from the collection of the old Boston Museum. A fine series of South American fishes, the gift of Mr. H. McK. Landon, consists of specimens identified by Prof. C. H. Eigenmann.

REPORT ON THE ENTOMOLOGICAL DEPARTMENT.

Mr. L. W. Swett has most kindly continued his work upon the collection of Geometridae, which has been enlarged and improved by this service.

Gifts of desirable specimens have been received from Messrs. J. M. Aldrich, C. P. Alexander, C. F. Batchelder, C. T. Brues (types of Diptera), B. P. Clark, (Sphingidae), J. W. Folsom (types of Collembola), E. D. Harris (Cicindelidae), C. W. Johnson (types of Diptera), J. R. Malloch, W. M. Mann (types of Coleoptera), A. P. Morse, F. W. Putnam, H. W. Smith (species from Sarawak), Roland Thaxter, W. M. Wheeler (types of ants), and H. F. Wickham.

Mention should also be made of the series of Arctic insects collected by Messrs. Dixon and Brooks, the gift of Col. J. E. Thayer and Prof. Theodore Lyman, and the collection from Guadeloupe made by Mr. G. K. Noble.

Routine work, including the identification and rearrangement of portions of the Diptera, Coleoptera, and Orthoptera has been continued; a large number of types have been located, catalogued, and labeled.

REPORT ON THE MYRIOPODS AND ARACHNIDS.

BY RALPH V. CHAMBERLIN.

During the year accessions of chilopods and diplopods, by gift or in return for identifications, were received from Miss E. B. Bryant, Profs. C. T. Brues, T. D. A. Cockerell, C. R. Crosby, C. A. Kofoid, W. M. Wheeler, Dr. W. M. Mann and Messrs. C. F. Baker, Nathan Banks, H. S. Barber, H. E. Denno, J. H. Emerton, E. H. Hardy, F. M. Webster, and the U. S. Department of Agriculture.

Additions to the collection of arachnids have been made by donations from Miss E. B. Bryant, Profs. C. T. Brues, Harold Heath, W. M. Wheeler, Mr. J. H. Emerton, who has presented additional types, and Mr. S. C. Chamberlin.

My time has been given largely to the arachnids. The collection of Aviculariidae was identified, labeled, and catalogued and a paper prepared embodying the description and illustration of the new forms. The collection of arachnids made by the Yale Peruvian Expedition of 1911 and presented to the Museum by Prof. H. W. Foote was also studied, labeled, and catalogued and a report embodying results completed. Routine work included the examination of numerous specimens of chilopods, diplopods, and arachnids sent in for identification. A beginning was made of a card catalogue of the chilopods.

REPORT ON THE ECHINODERMS.

BY HUBERT LYMAN CLARK.

The principal work of the year has been the preparation of an illustrated catalogue of the collection of brittle-stars (ophiurans), to be issued in recognition of the publication in October, 1865, of Lyman's Illustrated Catalogue of the same group. This work has involved not only extensive overhauling of the collection for the determination of type material, but also the description of many new species hitherto catalogued as unidentified.

A second work has been based on the echinoderms (except the holothurians) collected by the Australian fisheries investigation steamer ENDEAVOUR, during the years 1909-1914, undertaken for the authorities of the Australian Museum. A report, to appear in the Memoirs of that Museum, has been prepared and the collections have been returned to Sydney. For this service, the Museum receives the first series of duplicates, consisting of 280 specimens of seventy-nine species, twenty-seven of which are new to the collection, including twenty-one paratypes and representatives of four new genera. This is one of the most important additions made in recent years.

Work has been begun on the rearrangement of the collection of spatangoid sea-urchins, in connection with the study of the extensive series collected by the ALBATROSS in the Pacific and placed in Mr. Agassiz's hands for investigation. The remainder of the year has been given to the identification, labeling, and cataloguing of the accessions.

Aside from the ENDEAVOUR collection, the most important addition of the year is a fine lot of Philippine echinoderms, including a remarkable series of crinoids, generously presented by Dr. L. E. Griffin, formerly of Manila. There are nearly 600 specimens of ninety-three species, eighteen of which are new to the collection. Mr. Joseph Gabriel of Melbourne has continued his liberal policy of sending to the Museum such echinoderms as he gathers on his collecting trips, and during the past year he has given 186 specimens of nineteen species. Mr. E. C. Joshua, also of Melbourne,

has given a number of desirable holothurians and a fine series of beautifully mounted slides of holothurian spicules. Welcome gifts, for which thanks are due, have also been received from Messrs. W. F. Clapp, W. J. Crozier, H. Farquhar, W. A. Hilton, R. T. Jackson, H. Matsumoto, G. H. Parker, F. A. Potts, and H. W. Winkley.

From the U. S. National Museum the Museum has received a very valuable series of Panamic starfishes, including twenty-seven cotypes of Ludwig's species.

REPORT ON THE COELENTERATES.

BY HENRY B. BIGELOW.

The most important accessions received during the past year are the duplicate series of Medusae, ctenophores, siphonophores, and hydroids collected by the GRAMPUS in 1913 and 1914, and the duplicate set of Medusae collected by the U. S. Coast Survey steamer BACHE in the Gulf Stream, during the winter of 1914. Australian Medusae have been presented by Dr. H. L. Clark and Mr. J. Gabriel, and other specimens by Messrs. J. H. Blake and W. J. Crozier.

The collection now contains 303 species (about 10,000 specimens) of pelagic coelenterates (medusae, siphonophores, and ctenophores), and 159 species of hydroids. A catalogue of the stony corals has been commenced.

The H. A. Ward collection of corals from the Great Barrier Reef of Australia was identified by Prof. L. E. Griffin. This series contains seventy-four species and over 200 specimens.

The winter was spent on the report on the plankton and oceanography of the GRAMPUS cruise of 1914; and in sorting and identifying the BACHE medusae.

Since May 1 I have had charge of the scientific work of the U. S. Fisheries Schooner GRAMPUS, and while her main object has been an investigation of the Herring, I accompanied her on oceanographic cruises in the Gulf of Maine in May, June, and September. During the summer fifty oceanographic and plankton stations have been occupied, and the work is still in progress.

The remainder of the summer was spent in sorting the BACHE siphonophores, and in a visit to Prince Edward Island to study the oceanographic methods employed by Dr. Hjort in the Canadian government survey of Canadian waters.

REPORT ON INVERTEBRATE PALAEONTOLOGY.

BY PERCY E. RAYMOND.

During the year, a part of the fossils collected by Professor Twenhofel and myself in the course of the Shaler Memorial Expedition to the Baltic Region has been received. One box from Belgium, three from Russia, twelve from Sweden, and five from Norway have arrived, while eight boxes, containing all the Ordovician and Silurian fossils from Esthonia were, at last accounts, still at Libau, Russia. My time during the year has been devoted largely to the study of the Ordovician fossils which have been received, and the preparation of a report on the Expedition. Practically all the Ordovician trilobites have been identified, adding many genera and species not previously represented in the collections of the Museum. Among the trilobites the Asaphidae predominate, and many of the species are represented by complete specimens. In addition to the trilobites, the cephalopods and gastropods, and a large proportion of the brachiopods and cystids of the Russian collection have been identified. Among the cystids are a number of undescribed species.

Two short trips were made during the spring and summer to the Mohawk Valley of New York, on both of which trips a quantity of interesting material was collected. A new locality for the imperfectly known Tribes Hill fauna was discovered, and a collection obtained from it. Two weeks were spent in Pennsylvania, in studying and collecting fossils from certain Ordovician strata to obtain information needed for the completion of my report on the trip to the Baltic. The expenses of this trip were paid from the Shaler Memorial fund.

Mrs. N. A. Clapp rendered very efficient service for a few weeks in May and June, during which time she wrote many labels and catalogued a large number of specimens.

The following accessions, other than those mentioned above, have been received:—

By donation; forty specimens of invertebrate fossils from Prof. J. C. Moberg, Lund, Sweden.

By exchange; about 100 specimens of fossils from Dr. D. C. Barton, St. Louis, Mo., and fifty-two species of fossils from Prof. W. H. Twenhofel, Lawrence, Kansas.

By purchase; the Finkelnburg collection of about 500 specimens representing eighty-six species of Upper Cambrian fossils, and another collection containing about 300 specimens of Palaeozoic fossils from southwestern Virginia.

REPORT ON THE GEOLOGICAL COLLECTION.

BY ROBERT W. SAYLES.

During the past year there have been added to the exhibition collections 825 specimens.

Prof. W. M. Davis has very kindly given fifty specimens of beach sands collected during his trip to some of the coral islands of the Pacific in 1914. These specimens, Canada balsam mounts, give a good idea of the nature of beach materials among coral islands.

Through his tact and efficiency Mr. G. M. Flint's collecting trip in the summer of 1914 was most successful; he obtained over 1000 specimens of which 725 are catalogued and on exhibition.

A list of the localities visited and the nature of the materials collected includes:— *Buffalo, N. Y.*, cubes of N. Y. state building stones; *Cleveland, Ohio*, samples of building stones quarried in Ohio; *Berea, Ohio*, grindstone materials; *Latonia, Kent.*, fossiliferous limestone showing alteration rim; *Magnet Cove, Ark.*, specimens of syenites and a 10 lb. lodestone; *Hot Springs, Ark.*, novaculite, a collection of graptolites from the Silurian slates, and a section of pipe clogged by deposition from thermal waters; *Benton, Ark.*, Fuller's earth, bauxite, and residual clays with a set showing the various stages in the manufacture of pottery; *Berger, Ark.*, bauxite; *Little Rock, Ark.*, country rock of the Arkansas diamond mines; *Oklahoma City, Okl.*, cubes of building stones and economic specimens; *Ada, Okl.*, a set illustrating the manufacture of Portland cement; *El Paso, Tex.*, Portland cement specimens, a collection of typical Cretaceous (Comanchic) fossils, specimens of clays and coals; *Bisbee, Ariz.*, a large collection of stalagmites; *Tucson, Ariz.*, Hubnerite; *San Diego, Cal.*, cubes of building stones, a collection of Miocene rocks, a large mass of granite with segregations (from Dehesa); *Los Angeles, Cal.*, various building stones including a large slab of the newly discovered brecciated marble from the Mojave Desert, also economic specimens; *San Francisco, Cal.*, cubes of building stones, economic material, some small iridescent limonite stalactites from Shasta Co.; *Salt Lake City, Ut.*, a collection of Utah coals, Tintic ores, sets showing the manufac-

ture of salt from the Salt Lake brine, building stones including some beautiful marbles and onyx in polished slabs, some cone-in-cone specimens in the onyx; *Minneapolis, Minn.*, Wisconsin granites, slabs of various marbles and attractive panels of Kasota stone; *Cobalt, Ont.*, typical silver and cobalt ores, and specimens of conglomerate and tillite from the Trethewey mine.

The unique collection of stalagmites from the Shattuck Mine at Bisbee, Arizona, deserves special mention. The Company gave the stalagmites, and the Museum paid necessary expenses. Three of the stalagmites average six feet high with base rock enough to permit of a natural group. There is a claw-like stalagmite four feet high showing reddish coloration on the upper side and snow white on the under side. A large number of smaller stalagmites of remarkable shapes are colored yellow, cream, purple, red, and pink. Some of them are of the most pure white. Some have coral-like forms, and others are botryoidal or branching.

Thanks are due to Mr. R. P. Wentworth for specimens of coal and pre-Wisconsin till from Brighton, Mass., to Professor Raymond for a specimen of dent-marks from Russia, and to Professor Palache for specimens of folded gypsum and economic specimens. Professor Woodworth very kindly gave his best striated pebbles from the Permian tillite of Brazil.

Mr. George C. Curtis's model of Kilauea is nearing completion. On account of the difficulty of modeling the lavas, Mr. Curtis has been much delayed in finishing his work. From pictures obtained by kites, and taken by Mr. J. F. Haworth of Pittsburg, Mr. Curtis has been able to model the lavas with great accuracy.

Since the 17th of February, 1915, the Geological section of the Museum has been open to the public on four additional afternoons of each week, so that the collections can be seen on every day of the year except July 4th and Christmas day. This has been made possible by the generosity of the Visiting Committee in supplying a watchman for Monday, Tuesday, Wednesday and Friday afternoons. The watchman, Mr. Gurll, gives the attendance for the five months as follows:—March 6679; April 6788; May 8346; June 8309; July 10335; a total of 40457. The total for the new days of opening is a little over one third of the whole. Owing to the large attendance on Sundays, holidays, and a few other days, an accurate account was not possible and the figures given are below the actual number of visitors.

REPORT ON THE LIBRARY.

During the Museum year from August 1, 1914, to July 31, 1915, inclusive, 1,135 volumes, 1,287 parts of volumes, and 1,590 pamphlets have been added to the Library.

The total number of volumes in the Library is 52,634, the total number of pamphlets is 49,306.

The largest accession during the year came from the bequest of Dr. William McMichael Woodworth. Only a part of this bequest, amounting to 800 titles, has been entered.

Four hundred and fifty-five volumes have been bound; two thousand pamphlets have been separately bound.

PUBLICATIONS

FOR THE YEAR 1914-1915.

(1 AUGUST, 1914-31 JULY 1915).

MUSEUM OF COMPARATIVE ZOÖLOGY

BULLETIN:—

Vol. LV.

- No. 3. Harvard seismographic station. Fifth annual report including records, 1 August, 1912-31 December, 1913. By J. B. Woodworth. pp. 26. October, 1914.

Vol. LVII.

- No. 3. The genus *Watobius*. By Ralph V. Chamberlin. pp. 8. 2 Plates. September, 1914.

Vol. LVIII.

- No. 8. Reports on the scientific results of the expedition to the Tropical Pacific in charge of Alexander Agassiz, on the U. S. Fish Commission Steamer "Albatross," from August, 1899, to March, 1900, Commander Jefferson F. Moser, U. S. N., commanding. XVII. Reports on the scientific results of the expedition to the Eastern Tropical Pacific in charge of Alexander Agassiz, by the U. S. Fish Commission Steamer "Albatross," from October, 1904, to March, 1905, Lieut. Commander L. M. Garrett, U. S. N. commanding. XXVIII. Isopoda. By Harriet Richardson Searle. pp. 14. August, 1914.

- No. 9. A new *Peripatus* from Colombia. By Charles T. Brues. pp. 10. 2 plates. September, 1914.

- No. 10. Oceanography and plankton of Massachusetts Bay and adjacent waters, November, 1912-May, 1913. By Henry B. Bigelow. pp. 38. 1 plate. November, 1914.

- No. 11. New Miocene Coleoptera from Florissant. By H. F. Wickham. pp. 74. 16 plates. December, 1914.

Vol. LIX.

- No. 1. Mammals obtained by the Phillips Palestine expedition. By Glover M. Allen. pp. 14. February, 1915.

- No. 2. The cranial nerves of *Anolis carolinensis*. By William A. Willard. pp. 102. 7 plates. July, 1915.

- No. 3. Relics of Peale's Museum. By Walter Faxon. pp. 32. July, 1915.

MEMOIRS: —

Vol. XL.

No. 9. Studies from the Newport Marine Laboratory. XVI. The development of osseous fishes. II. The pre-embryonic stages of development. Part 2.— The history of the egg: cleavage, formation of the periblast, and development of the germ ring. By Alexander Agassiz and C. O. Whitman. pp. 6. 11 plates. April, 1915.

Vol. XLII.

Reports on the scientific results of the expedition to the Eastern Tropical Pacific, in charge of Alexander Agassiz, by the U. S. Fish Commission Steamer "Albatross," from October, 1904, to March, 1905, Lieut. Commander L. M. Garrett, U. S. N., commanding, and of other expeditions of the "Albatross," 1891-1899. XXIX. The sponges. 3. Hexactinellida. By Robert von Lendenfeld. pp. 397. 109 plates. June, 1915.

REPORT: —

1913-1914. pp. 51. December, 1914.

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CONTRIBUTIONS: —

250. CROZIER, W. J.— The growth of the shell in the lamellibranch *Dosinia discus* (Reeve). *Zool. jahrb., Abt. f. anat.*, December, 1914, **38**, p. 577-584, pl. 35.
252. PATTEN, B. M.— A quantitative determination of the orienting reaction of the blowfly larva (*Calliphora erythrocephala* Meigen). *Journ. exper. zööl.*, August [September], 1914, **17**, p. 213-280.
253. RAND, H. W.— Wound closure in actinian tentacles with reference to the problem of organization. *Arch. f. entwicklungs-mechanik*, January, 1915, **41**, p. 159-214.
254. AREY, L. B.— An abnormality in the intestine of *Necturus maculosus* Raf. *Anat. record*, November, 1914, **8**, p. 493-498.
255. CROZIER, W. J.— The orientation of a holothurian by light. *Amer. journ. physiol.*, December, 1914, **36**, p. 8-20.
256. CROZIER, W. J.— On the number of rays in *Asterias tenuispina* Lamk. at Bermuda. *Amer. nat.*, January, 1915, **49**, p. 28-36.
257. ROBERTSON, W. R. B.— Chromosome studies. III. Inequalities and deficiencies in homologous chromosomes: their bearing upon synapsis and the loss of unit characters. *Journ. morphol.*, March, 1915, **26**, p. 109-141, 3 pls.
258. CROZIER, W. J.— A note on the physiology of the Cuvierian organs of *Holothuria captiva* Ludw. *Amer. journ. physiol.*, January, 1915, **36**, p. 196-202.
259. AREY, L. B.— The orientation of *Amphioxus* during locomotion. *Journ. exper. Zööl.*, July, 1915, **19**, p. 37-44.
261. See p. 40. *Bull.* **59**, no. 2.

BERMUDA BIOLOGICAL STATION FOR RESEARCH.

CONTRIBUTIONS: —

33. See *supra*, *Contrib. Zoöl. Lab.*, 251.
 34. See *supra*, *Contrib. Zoöl. Lab.*, 255.
 35. See *supra*, *Contrib. Zoöl. Lab.*, 256.
 36. See *supra*, *Contrib. Zoöl. Lab.*, 259.
 37. See *supra*, *Contrib. Zoöl. Lab.*, 258.
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See p. 40. *Bull.* **58**, no. 9.

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INVESTED FUNDS OF THE MUSEUM.

IN THE HANDS OF THE TREASURER OF HARVARD COLLEGE.

Gray Fund	\$50,000.00
Permanent Fund	117,469.34
Humboldt Fund	8,077.73
Sturgis Hooper Fund	107,410.45
Agassiz Memorial Fund	297,933.10
Teachers and Pupils Fund	7,594.01
Virginia Barret Gibbs Fund	6,606.52
Willard Peele Hunnewell Memorial Fund	5,605.49
Maria Whitney Fund	6,390.32
Alexander Agassiz Fund	99,500.00
Alexander Agassiz Expedition Fund	81,500.11
George Russell Agassiz Fund	100,000.00
Maria Whitney and James Lyman Whitney Fund	205.99
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	\$888,293.06

The payments on account of the Museum are made by the Bursar of Harvard College, on vouchers approved by the Director. The accounts are annually examined by a committee of the Overseers. The only funds the incomes of which are restricted, the Gray, the Humboldt, the Whitney, and the Alexander Agassiz Expedition Funds, are annually charged in an analysis of the accounts, with vouchers, to the payment of which the incomes are applicable.

The income of the Gray Fund can be applied to the purchase and maintenance of collections, but not for salaries.

The income of the Humboldt Fund (about \$300.) can be applied for the benefit of one or more students of Natural History, either at the Museum, the United States Fish Commission Station at Woods Hole, the Stations at Bermuda, or the Tortugas.

The income of the Whitney Funds can be applied for the care (binding) and increase of the Whitney Library.

The Alexander Agassiz Expedition Fund was bequeathed by Alexander Agassiz for the publication of reports on collections brought together by the expeditions with which he was connected.

The income of the Virginia Barret Gibbs Scholarship Fund, of the value of \$250., is assigned annually with the approval of the Faculty of the Museum, on the recommendation of the Professors of Zoölogy and of Comparative Anatomy in Harvard University, "in supporting or assisting to support one or more students who may have shown decided talents in Zoölogy, and preferably in the direction of Marine Zoölogy."

Applications for the tables reserved for advanced students at the Woods Hole Station should be made to the Faculty of the Museum before the 1st of May. Applicants should state their qualifications, and indicate the course of study they intend to pursue.

The following Publications of the Museum of Comparative Zoölogy are in preparation:—

- LOUIS CABOT. Immature State of the Odonata, Part IV.
E. L. MARK. Studies on Lepidosteus, continued.
E. L. MARK. On Arachnactis.
H. L. CLARK. The "Albatross" Hawaiian Echini.

Reports on the Results of Dredging Operations in 1877, 1878, 1879, and 1880, in charge of ALEXANDER AGASSIZ, by the U. S. Coast Survey Steamer "Blake," as follows:—

- A. MILNE EDWARDS and E. L. BOUVIER. The Crustacea of the "Blake."
A. E. VERRILL. The Alcyonaria of the "Blake."

Reports on the Results of the Expedition of 1891 of the U. S. Fish Commission Steamer "Albatross," Lieutenant Commander Z. L. TANNER, U. S. N., Commanding, in charge of ALEXANDER AGASSIZ, as follows:—

- | | |
|---|---|
| K. BRANDT. The Sagittae. | W. A. HERDMAN. The Ascidians. |
| K. BRANDT. The Thalassicolae. | S. J. HICKSON. The Antipathids. |
| O. CARLGREN. The Actinarians. | E. L. MARK. Branchiocerianthus. |
| R. V. CHAMBERLIN. The Annelids. | JOHN MURRAY. The Bottom Specimens. |
| W. R. COE. The Nemerteans. | P. SCHIEMENZ. The Pteropods and Heteropods. |
| REINHARD DOHRN. The Eyes of Deep-Sea Crustacea. | THEO. STUDER. The Alcyonarians. |
| H. J. HANSEN. The Cirripeds. | — The Salpidae and Doliolidae. |
| H. J. HANSEN. The Schizopods. | H. B. WARD. The Sipunculids. |
| HAROLD HEATH. Solenogaster. | |

Reports on the Scientific Results of the Expedition to the Tropical Pacific, in charge of ALEXANDER AGASSIZ, on the U. S. Fish Commission Steamer "Albatross," from August, 1899, to March, 1900, Commander Jefferson F. Moser, U. S. N., Commanding, as follows:—

- | | |
|---------------------------------|---|
| R. V. CHAMBERLIN. The Annelids. | MARY J. RATHBUN. The Crustacea Decapoda. |
| H. L. CLARK. The Holothurians. | G. O. SARS. The Copepods. |
| H. L. CLARK. The Ophiurans. | L. STEJNEGER. The Reptiles. |
| — The Volcanic Rocks. | C. H. TOWNSEND. The Mammals, Birds, and Fishes. |
| — The Coralliferous Limestones. | T. W. VAUGHAN. The Corals, Recent and Fossil. |
| S. HENSHAW. The Insects. | |
| G. W. MÜLLER. The Ostracods. | |

PUBLICATIONS
OF THE
MUSEUM OF COMPARATIVE ZOÖLOGY
AT HARVARD COLLEGE.

There have been published of the BULLETIN Vols. I. to LIV. and Vols. LVIII. and LIX.; of the MEMOIRS, Vols. I. to XXIV., and also Vols. XXVI. to XXIX., XXXI. to XXXIV., XXXVI. to XXXVIII., XL. to XLII., and XLIV.

Vols. LV. to LVII., LX. and LXI. of the BULLETIN, and Vols. XXV., XXX., XXXV., XXXIX., XLIII., XLV. to XLIX. of the MEMOIRS, are now in course of publication.

The BULLETIN and MEMOIRS are devoted to the publication of original work by the Officers of the Museum, of investigations carried on by students and others in the different Laboratories of Natural History, and of work by specialists based upon the Museum Collections and Explorations.

The following publications are in preparation:—

Reports on the Results of Dredging Operations from 1877 to 1880, in charge of Alexander Agassiz, by the U. S. Coast Survey Steamer "Blake," Lieut. Commander C. D. Sigsbee, U. S. N., and Commander J. R. Bartlett, U. S. N., Commanding.

Reports on the Results of the Expedition of 1891 of the U. S. Fish Commission Steamer "Albatross," Lieut. Commander Z. L. Tanner, U. S. N., Commanding, in charge of Alexander Agassiz.

Reports on the Scientific Results of the Expedition to the Tropical Pacific, in charge of Alexander Agassiz, on the U. S. Fish Commission Steamer "Albatross," from August, 1899, to March, 1900, Commander Jefferson F. Moser, U. S. N., Commanding.

Reports on the Scientific Results of the Expedition to the Eastern Tropical Pacific, in charge of Alexander Agassiz, on the U. S. Fish Commission Steamer "Albatross," from October, 1904, to April, 1905, Lieut. Commander L. M. Garrett, U. S. N., Commanding.

Contributions from the Zoölogical Laboratory, Professor E. L. Mark, Director.
Contributions from the Geological Laboratory, Professor R. A. Daly, in charge.

These publications are issued in numbers at irregular intervals. Each number of the Bulletin and of the Memoirs is sold separately. A price list of the publications of the Museum will be sent on application to the Director of the Museum of Comparative Zoölogy, Cambridge, Mass.

